

REMARKS

Examiner L. Umez-Eronini is thanked for the thorough examination and search of the subject Patent Application.

Claim 11 has been amended and Claims 21-30 are hereby canceled.

The Examiner is thanked for withdrawing the rejections under 35 U.S.C. 112.

Reconsideration of the rejection under 35 U.S.C. 103 of Claims 1, 3, and 5 as being unpatentable over Chow in view of Toshiaki and further in view of Kudo and Havemann is requested in accordance with the following remarks.

Claim 1 details a via-first dual damascene method as shown in Figs. 1-7. The key feature of Applicants' invention is that no high dielectric constant material is required as an etch stop or barrier layer (see page 6 of the Specification). Chow shows the use of etch stop layers. It is agreed that Toshiaki lacks an etch stop layer, but Chow in view of Toshiaki does not teach using the patterned inorganic dielectric layer as a mask.

It is agreed that Kudo et al teaches using an inorganic film as a hard mask (col. 14, lines 34-41). However, the via and trench in Kudo are both formed in the single organic film 62. This differs from Applicants' invention where the via is formed in the organic layer and the trench is formed in the inorganic layer (see Fig. 6 and Claim 1). It is this patterned inorganic layer into which the trench has been etched that acts as a mask for the via etch into the organic layer. Thus, it is not agreed that the combination of Kudo with Chow and Toshiaki teaches uses the patterned inorganic layer as a mask.

It is agreed that Havemann teaches that an underlying organic layer acts as an etch stop for an inorganic layer. However, as discussed above, it is believed that the combination of references does not teach or suggest the use of the patterned inorganic layer as an etching mask.

Reconsideration of the rejection under 35 U.S.C. 103 of Claims 1, 3, and 5 as being unpatentable over Chow in view of Toshiaki and further in view of Kudo is requested in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103 of

Claim 2 as being unpatentable over Chow in view of Toshiaki, Kudo, and Havemann and further in view of Joshi et al is requested in accordance with the following remarks.

It is agreed that Joshi et al teaches forming semiconductor devices wherein metal lines overlie the devices. However, it is believed the combination of references does not teach or suggest using the patterned inorganic layer as a mask in etching the via into the organic layer.

Reconsideration of the rejection under 35 U.S.C. 103 of Claim 2 as being unpatentable over Chow in view of Toshiaki, Kudo, and Havemann and further in view of Joshi et al is requested in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103 of Claim 4 as being unpatentable over Chow in view of Toshiaki, Kudo, and Havemann and further in view of Wang et al is requested in accordance with the following remarks.

It is agreed that Wang et al teaches forming a dielectric layer that can comprise silicon dioxide or another material such as FSG. However, this layer is used as an etch stop layer in etching an overlying nitride layer (col. 6,

lines 65-67) and then as a hard mask for etching the underlying metal layer (col. 8, lines 20-29). This has nothing to do with the low-k dielectric layer of Applicants' invention through which a dual damascene opening is made. Furthermore, it is believed that the combination of references does not teach or suggest the use of the patterned inorganic layer as an etching mask.

Reconsideration of the rejection under 35 U.S.C. 103 of Claim 4 as being unpatentable over Chow in view of Toshiaki, Kudo, and Havemann and further in view of Wang et al is requested in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103 of Claims 6, 8, and 10 as being unpatentable over Chow in view of Toshiaki is requested in accordance with the following remarks.

It is agreed that Chow does not teach the absence of an etch stop layer or etching a via pattern into an organic layer through the trench pattern. It is agreed that Toshiaki teaches forming a via pattern into an organic layer 3 through the hard mask's pattern 4. However, this does not complete formation of the dual damascene opening. Toshiaki must then etch the via pattern into

the underlying inorganic layer 2 and etch the trench pattern into the organic layer 3. Claim 6 claims that the etching of the via pattern into the organic layer through the trench pattern serves "to complete said forming of said dual damascene openings" (lines 14-17).

Reconsideration of the rejection under 35 U.S.C. 103 of Claims 6, 8, and 10 as being unpatentable over Chow in view of Toshiaki is requested in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103 of Claim 7 as being unpatentable over Chow in view of Toshiaki and further in view of Joshi et al is requested in accordance with the following remarks.

It is agreed that Joshi et al teaches forming semiconductor devices wherein metal lines overlie the devices. However, as discussed above, the combination of references does not teach the completion of the dual damascene openings by etching the trench pattern into the inorganic layer and thereafter etching the via pattern into the organic layer through the trench pattern as claimed in Claim 6.

Reconsideration of the rejection under 35 U.S.C. 103 of Claim 7 as being unpatentable over Chow in view of Toshiaki further in view of Joshi et al is requested in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103 of Claim 9 as being unpatentable over Chow in view of Toshiaki and further in view of Wang et al is requested in accordance with the following remarks.

As discussed above, it is agreed that Wang et al teaches forming a dielectric layer that can comprise silicon dioxide or another material such as FSG. However, this layer is used as an etch stop layer in etching an overlying nitride layer (col. 6, lines 65-67) and then as a hard mask for etching the underlying metal layer (col. 8, lines 20-29). This has nothing to do with the low-k dielectric layer of Applicants' invention through which a dual damascene opening is made. Furthermore, as discussed above, the combination of references does not teach the completion of the dual damascene openings by etching the trench pattern into the inorganic layer and thereafter etching the via pattern into the organic layer through the trench pattern as claimed in Claim 6.

Reconsideration of the rejection under 35 U.S.C. 103 of Claim 9 as being unpatentable over Chow in view of Toshiaki and further in view of Wang et al is requested in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103 of Claims 11, 13, and 15 as being unpatentable over Chow in view of Toshiaki is requested in view of Amended Claim 11 and in accordance with the following remarks.

It is agreed that Chow does not teach the absence of an etch stop layer. It is agreed that Toshiaki does not show an etch stop layer. It is agreed that Toshiaki discloses different etching recipes for different layers. However, Toshiaki teaches etching a trench pattern into the inorganic hard mask layer 4, etching a via pattern into the organic layer 3 and the inorganic layer 2, and etching the trench pattern into the organic layer 3. In amended Claim 11, Applicants' detail etching the via pattern into the inorganic layer and thereafter etching the via pattern into the organic layer and the trench pattern into the inorganic layer to complete the dual damascene openings. The completed dual damascene openings of Toshiaki have a trench pattern in the organic layer and a via pattern in the inorganic layer.

Furthermore, more steps are used in Toshiaki than in Applicants' process for forming the openings.

Reconsideration of the rejection under 35 U.S.C. 103 of Claims 11, 13, and 15 as being unpatentable over Chow in view of Toshiaki is requested in view of Amended Claim 11 and in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103 of Claim 12 as being unpatentable over Chow in view of Toshiaki and further in view of Joshi et al is requested in view of Amended Claim 11 and in accordance with the following remarks.

It is agreed that Joshi et al teaches forming semiconductor devices wherein metal lines overlie the devices. However, it is believed that the amendment to Claim 11 makes clear Applicants' self-aligned method that is not taught or suggested by the references.

Reconsideration of the rejection under 35 U.S.C. 103 of Claim 12 as being unpatentable over Chow in view of Toshiaki and further in view of Joshi et al is requested in view of Amended Claim 11 and in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103 of Claim 14 as being unpatentable over Chow in view of Toshiaki and further in view of Wang et al is requested in view of Amended Claim 11 and in accordance with the following remarks.

As discussed above, it is agreed that Wang et al teaches forming a dielectric layer that can comprise silicon dioxide or another material such as FSG. However, this layer is used as an etch stop layer in etching an overlying nitride layer (col. 6, lines 65-67) and then as a hard mask for etching the underlying metal layer (col. 8, lines 20-29). This has nothing to do with the low-k dielectric layer of Applicants' invention through which a dual damascene opening is made. Furthermore, it is believed that the amendment to Claim 11 makes clear Applicants' self-aligned method that is not taught or suggested by the references.

Reconsideration of the rejection under 35 U.S.C. 103 of Claim 14 as being unpatentable over Chow in view of Toshiaki and further in view of Wang et al is requested in view of Amended Claim 11 and in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103 of

Claims 16, 19, and 20 as being unpatentable over Chow in view of Toshiaki and further in view of Dennison et al is requested in accordance with the following remarks.

It is agreed that Chow in view of Toshiaki fails to teach that the inorganic dielectric layer acts as an etch stop. It is not agreed that the citation from Dennison, col. 3, lines 46-50, provides evidence that an inorganic dielectric layer acts as an etch stop for an overlying organic dielectric layer. Etch stop layer 16 acts as an etch stop during polishing or etching back of an overlying metal layer (col. 4, lines 21-25). The layer is not used as an etch stop in etching a dielectric layer.

Reconsideration of the rejection under 35 U.S.C. 103 of Claims 16, 19, and 20 as being unpatentable over Chow in view of Toshiaki and further in view of Dennison et al is requested in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103 of Claim 17 as being unpatentable over Chow in view of Toshiaki and further in view of Joshi et al is requested in view of Amended Claim 16 and in accordance with the following remarks.

It is agreed that Joshi et al teaches forming semiconductor devices wherein metal lines overlie the devices. However, it is believed that the amendment to Claim 16 makes it clear that the key feature of Applicants' invention not taught in the prior art is a via first dual damascene process without an etch stop layer between the two low-k dielectric layers where the via is formed in the first dielectric layer and the trench is formed within the second dielectric layer and wherein the bottom layer acts as an etch stop when the trench is etched into the top layer.

Reconsideration of the rejection under 35 U.S.C. 103 of Claim 17 as being unpatentable over Chow in view of Toshiaki and further in view of Joshi et al is requested in view of Amended Claim 16 and in accordance with the remarks above.

Reconsideration of the rejection under 35 U.S.C. 103 of Claim 18 as being unpatentable over Chow in view of Toshiaki and further in view of Wang et al is requested in view of Amended Claim 16 and in accordance with the following remarks.

It is agreed that Wang et al teaches forming a dielectric layer that can comprise silicon dioxide or another

material such as FSG. However, this layer is used as an etch stop layer in etching an overlying nitride layer (col. 6, lines 65-67) and then as a hard mask for etching the underlying metal layer (col. 8, lines 20-29). This has nothing to do with the low-k dielectric layer of Applicants' invention through which a dual damascene opening is made. Furthermore, it is believed that the amendment to Claim 16 makes it clear that the key feature of Applicants' invention not taught in the prior art is a via first dual damascene process without an etch stop layer between the two low-k dielectric layers where the via is formed in the first dielectric layer and the trench is formed within the second dielectric layer and wherein the bottom layer acts as an etch stop when the trench is etched into the top layer.

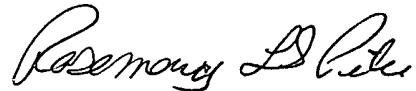
Reconsideration of the rejection under 35 U.S.C. 103 of Claim 18 as being unpatentable over Chow in view of Toshiaki and further in view of Wang et al is requested in view of Amended Claim 16 and in accordance with the remarks above.

Allowance of all Claims is requested.

It is requested that should Examiner Umez-Eronini not find that the Claims are now Allowable that she call the undersigned at 765 4530866 to overcome any problems

preventing allowance.

Respectfully submitted,



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